## REMARKS

Applicant respectfully requests reconsideration of this application. Claims 1-30 are pending.

Claims 1, 10, 19, and 28 have been amended. No claims have been cancelled or added.

Therefore, claims 1-30 are hereby presented for examination

### 35 U.S.C. §103

### Liao in view of Greene

The Final Office Action rejects claims 1-30 under 35 U.S.C. §103(a) as being unpatentable over US Patent 7,054,315 of Liao (hereinafter "*Liao*") in view of US Patent No. 6,778,530 of Greene (hereinafter "*Greene*").

Claim 1, as clarified herein, is as follows:

> 1. A method comprising:
>
> grouping single fields of a multiple-field source into a plurality of multiple-field keys (MFKs) of a search target, each MFK of the search target having single fields that correspond to single fields in one of a plurality of multiple-field vectors (MFVs) of entries in a data structure;
>
> generating a set of queries based, at least in part, on the MFKs, wherein each query includes one or more of the MFKs and wherein each query has a different MFK as a lead MFK;
>
> using a query to determine whether the non-wildcard values in the MFVs of an entry match the non-wildcard values in corresponding MFKs of the search target; and
>
> if no entry has non-wildcard values in the MFVs that match the corresponding non-wildcard values in the MFKs, then using the queries to determine whether the entry has non-wildcard values in a MFV that match

> the non-wildcard values in a corresponding lead MFK, plus remaining MFVs that match corresponding remaining MFKs based on matching the non-wildcard values and wildcard values.

Thus, claim 1 includes "grouping single fields of a multiple-field source into a plurality of multiple-field keys (MFKs) of a search target". The claim further provides that "each MFK of the search target having single fields that correspond to single fields in one of a plurality of multiple-field vectors (MFVs) of entries in a data structure". There are then appropriate queries that are generated with regard to the MFK "generating a set of queries based, at least in part, on the MFKs, wherein each query includes one or more of the MFKs and wherein each query has a different MFK as a lead MFK".

The claim also includes the further claim elements regarding a search, providing for using a query to determine whether the non-wildcard values in MFVs of an entry match the non-wildcard values in corresponding MFKs of the search target, and, if no entry has non-wildcard values in the MFVs that match the corresponding non-wildcard values in the MFKs, then using the queries to determine whether the entry has non-wildcard values in a MFV that match the non-wildcard values in a corresponding lead MFK, plus remaining MFVs that match corresponding remaining MFKs based on matching the non-wildcard values and wildcard values.

*Liao* regards masked matching, and is intended to reduce the search space that is processed by mask matching methods. However, the manner in which this is done does not relate to the grouping of fields of a multiple field source. Rather, the elements that are being grouped in *Liao* are possible related bit patterns. "The search space is reduced by grouping the candidate bit patterns into groups and subgroups that have internal bit

agreement between the members. By only applying the mask matching methods to a select number of groups selected by their bit agreement with the target bit pattern, the computation time and memory requirement of the mask matching method is reduced." (*Liao*, Abstract) While searching efficiency is intended by *Liao*, the reference is addressing this general goal in a different manner.

This can be seen in the portions of the reference that have been cited by the Office Action. The Office Action cites to elements 130, 140, 150, and 160 of Figure 5 as MFKs, indicating that these correspond to single fields in multiple field vectors ps0 and ps1 of Figure 5. However, what is represented in Figure 5 does not relate to multiple fields of any kind, but rather multiple possible search candidates.

To address this step by step, a Patricia tree is a data structure used in search database, the tree being a binary tree with each internal node having two branches and bit index value. (*Liao*, col. 7, lines 10-14) Figure 1 illustrates a Patricia tree using rule set shown in a table (*Liao*, col. 7, lines 45-52) (where a rule set is a collection of filter rules). The elements of the table are <u>not</u> fields of a source, but rather various candidates for searching. Stated in another way, these are possible bit patterns to match, representing multiple possible values of the six-bit field that is being used in this example. *Liao* then intends to use the concept of the Patricia tree to reduce the search space needed for a match, which is needed because matching the rule set with a wild card requires expanding to cover the wild card space. (*Liao*, col. 8, lines 14-22)

With this background, Figure 4 describes the generation of elements 130, 140, 150, and 160. From the text of *Liao*, it can be seen that is a certain set of candidate bit patterns shown in Table 1. (*Liao*, col. 10, lines 9-20) Table 1 does contain a rule set that

has wild card or "don't care" (represented as 'x') values. Given this, the tree 100 of Figure 4 is generated, which contains group1 (having the candidates with '1' in the initial bit), group0 ('0' in the initial bit), and groupx ('x' – the wild card bit – in the initial bit). These then are divided into subgroups, boxes 110 and 120 using the third and fourth bit positions. Ultimately the subgroups represented in boxes 130, 140, 150, and 160 are produced, with the elements in each group having common bit patterns.

From this result, the process proceeds with packaging the subgroups into "physical sets" in Figure 5, where the elements that are common to the subgroups are only represented once in the physical set. Once this is done, there is used in a determination whether the target bit pattern matches a candidate bit pattern. This can be seen in Figure 6, in which a search proceeds from the '0' index position ('1' in this example) to the '4' index position (value of '0'), which then results in calling a particular index (2), which denotes a particular physical set (PS1). This is retrieved, and the matching pattern is applied to the physical set using the target bit pattern. (*Liao*, col. 12, lines 49-65)

Thus, what is being done is *Liao* is very different than what is described in claim 1. Rather than grouping together fields of a multiple field source into a search target having multiple-field keys and generating queries using these multiple field keys, *Liao* is concerned with grouping together candidate bit patterns.

To describe this diagrammatically, claim 1 regards a multiple field source (such as Figure 5A of the current application). These are not values for a particular field (as in *Liao*), but rather are single fields of a source that are grouped together into the MFKs. The search target has these grouped MFKs. The queries are generated based, at least in

part, on the MFKs, with each query having a different MFK (a different grouping of fields) as a lead MFK. In contrast, what *Liao* is concerned about is the possible values for any particular field in a search and how this affects searching. These values are grouped together, and the grouped values are used in searching, as shown in, for example, Figure 6 of *Liao*.

The Office Action then states that "Liao does not specifically show single fields of a multiple-field source." Claim 1, as amended herein, indicates that the single fields of a multiple-field source are grouped into a plurality of multiple-field keys (MFKs) of a search target. As such, it is submitted that none of the discussion of *Liao* is actually relevant because if there are no single fields of a multiple-field source to be grouped into MFKs, then none of the elements of the claim can be shown. However, to examine the other reference, the Office Action cites to *Greene* for the grouping of single fields of a multiple-field source. *Greene* regards multiple field matching in a network device. The Office Action cites to "fig. 2 (1200)", but this appears to be a typographical error. It is assumed that the citation is to Figure 12, which contains a particular embodiment 1200. The Office cites to the following text of the summary of *Greene*:

> According to disclosed embodiments, a system provides multiple-field matching capabilities for table searching. The matching is based on multiple key fields where each rule has a specification (such as a range or prefix) or a wild card in each field. A rule match occurs when all fields of the search satisfy the corresponding fields of the rule. The system includes a number of single field lookup engines that are connected together in a pipelined fashion. In one embodiment, the pipelined arrangement allows the system to provide one multiple field lookup result per memory clock cycle. In another embodiment, a smaller number of lookup engines can be

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> employed to provide one multiple field lookup result for every two memory clock cycles.

(*Greene*, col. 12, line 65 to col. 3, line 10) This is an indication that there is matching based on multiple fields. For example, the reference indicates that Figure 1 represents a "multiple field key". However, the combination of these portions of the application with *Liao* does not teach or suggest the elements of the claims. The grouping illustrated in *Liao* does not regard, or make sense in connection with, multiple field keys. As shown above, *Liao* regards the combination of very different elements, these being the possible candidate bit patterns. This has no relation to what is described in *Greene*. Further, *Greene* does not contain the elements missing from *Liao*. While regarding multiple field searching and while Figure 1 is described as a "multiple field key", there is no teaching or suggestion of the grouping single fields of a multiple-field source <u>into a plurality of multiple-field keys of a search target</u>. *Greene* describes certain matching processes such as illustrated in Figures 7, 8, 9, 10, and 12, but these do not appear to have any relation to the elements of claim 1.

Thus, claim 1 is patentable over *Liao* and *Greene*. It is submitted that the arguments presented above with regard to claim 1 also apply to independent claims 10, 19, and 28, and such claims are also allowable. The remaining claims are dependent claims and are allowable as being dependent on the allowable base claims.

## CONCLUSION

Applicant respectfully submits that the rejections have been overcome by the amendment and remark, and that the claims as amended are now in condition for

allowance. Accordingly, Applicant respectfully requests the rejections be withdrawn and the claims as amended be allowed.

**Invitation for a Telephone Interview**

The Examiner is requested to call the undersigned at (503) 439-8778 if there remains any issue with allowance of the case.

**Request for an Extension of Time if Needed**

The Applicant respectfully petitions for an extension of time to respond to the outstanding Office Action pursuant to 37 C.F.R. § 1.136(a) should one be required. Please charge the fee for any extension of time to our Deposit Account No. 02-2666.

**Charge our Deposit Account**

Please charge any shortage to our Deposit Account No. 02-2666.

Respectfully submitted,

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